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# DEVELOPMENT CONCEPTS FOR GEORGIAN MOES GIS SYSTEM – MAY 2012

**GEORGIA EDUCATION MANAGEMENT PROJECT (EMP)  
SHORT-TERM TECHNICAL ASSISTANCE REPORT**

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## Acronyms

EMIS	Education Management Information System
EMP	Education Management Project
ERC	Education Resource Center
GB	Gigabyte
GIS	Geographic Information System
IRM	Information Resources Management
MoES	Ministry of Education and Science
MOU	Memorandum of Understanding
RAM	Random Access Memory
SIS	Student Information System
SAN	Storage Area Network
SQL	Structured Query Language
TB	Terabyte
TOR	Terms of Reference

## Introduction

The ministry of education has acquired a GIS system to help it improve the delivery of education services. GIS systems are complex and multi-dimensional and the ministry will need to develop a focus on what it intends to use the GIS system for.

GIS systems are most often used to facilitate one or more of six functions:

1. Create the necessary conditions for achieving universal primary and secondary education (UPE and USE),
2. Increase access for females and members of other traditionally under-represented socio-economic groups,
3. Promote the equitable distribution of educational benefits within and between different regions and populations,
4. Improve the quality of educational efforts,
5. Optimize the efficient use of existing capital, human and financial resources, and
6. Organize, coordinate and rationalize efforts at technical, vocational, and post-secondary education.

In discussions with ministry officials the Georgian MoES there are clear indications that early on it will attempt to concentrate on functions 3, 4, and 5. What then are the necessary data elements that the ministry will need to address these functions and how should these data elements be created and stored for both immediate and long-term use by the ministry? This document, prepared jointly by Jesse Rodriguez and Giorgi Nanobashvili, will attempt to address these issues in the following pages.

## How will the MoES likely use the GIS System

If we expand on the 3 functions enumerated above it is likely the ministry will want to drill down on data related to the following issues:

1. A diagnosis of the existing educational situation in the base year:
  - a. Existing inequalities in access by impacted area(s) and group(s).
  - b. Efficiency issues such as repetition and drop-out rates (wastage).
  - c. Disparities in elements impacting quality such as facilities, teachers, equipment and supplies.
2. Detailed projection of enrollment demand potential, including definitions of optimal attendance area(s) for the school(s).
  - a. Projected impact on school facilities to accommodate increased or decreased enrollment.
  - b. Projected impact on teacher pool, equipment and supplies.

3. Estimation of numbers and identification of locations where schools are to be opened (and perhaps closed).
  - a. Teacher transfers and distribution.
  - b. School calendar modifications to increase student participation.
  - c. Measures to encourage attendance such as transportation, school meals and free school book programs.
4. Estimation of facilities, resources and supplies to be provided in schools.
5. Cost estimations.

So the question then is how to we begin the process of answering questions related to the aforementioned issues?

### Process for developing the GIS system for the ministry

Given the resources, both human and data availability, it is recommended that the ministry formulate a concrete plan for those areas it plans to collect, analyze data and how it plans to use the GIS to disseminate the information the resulting information to teachers, administrators, parents, students, etc. Put another way, the ministry first needs to understand what it is it wants to know, how it plans to go about getting the data to answer what it is it wants to know, and how it plans to use that that data once it knows, and finally, how it will share its findings with it stakeholders.

The first step should be fairly simple to arrive at but once determined it should be formalized and understood and agreed upon by all facets of the organization. This will then allow staff to create an assessment of what data exists, how it is formatted and how easy it will be to use. As part of this iterative process, the ministry will also reach an understanding of what data does not exist that must, moving forward, be captured in order to answer the agreed upon issues in the plan. Finally, the ministry will need to tackle the issue of system will be the prime creator of the data needed, how this data will be stored and collated in the data warehouse, and how the GIS mapping system will be used to develop the spatial maps that will be incorporated into the agreed upon reports for the respective stakeholders. A clear example of this is how the GIS can reconstitute the data being collected by the different ministry systems, store it in an easy to use format on the data warehouse, and create the appropriate reports to allow for the school report cards to be created.

To make this all possible will mean that the ministry will need to quickly decide what within or in addition to the five issues enumerated above it wants to concentrate on so that staff can then begin the process of doing a cross walk against the data structures contained within the **Data Warehouse Fields** document put together by Giorgi Nanobashvilli.

As a first exercise, it is recommended the ministry develop a fairly simple plan to determine what sort of issues is likely to encounter as it goes about the process of fully utilizing the GIS system and to prioritize which areas it will concentrate on first, second, third, etc.

Moving forward in this manner will allow the ministry to quickly, within a few weeks, to have a fairly comprehensive idea of what areas it will concentrate on and can then create a project plan with cost estimates on how and when it will be able to begin to provide the necessary data driven information in an easy to understand way, so that the ministry can make strategic decisions about programs, staff and resources.

### **Recommendations for Data Elements to Be Used by GIS System**

Using the **Data Warehouse Fields** document compiled by Giorgi Naobashvilli, the following data elements might be ones the ministry might want to consider for inclusion for use by the GIS system. These elements do not need to be used all at one time but can be added over time as time and resources allow. The key to the use of these elements is that they are to allow the ministry to do comparison that point to why or why not there is student achievement, and where, as well as linking this data to the teaching staff to see the impact that teaching staff may or may not affect student achievement. Finally, some of the elements related to the status of the buildings and the impact they may or may not have on improving achievement, providing information as to where new schools should be built, which schools should be closed, which schools need additional attention, etc. The end result of the combining, comparing and contrast all three data element groups should allow the ministry to have a much better understanding of where it stands as an organization and where to put focus moving forward. The data elements contained herein would be a good starting point for the developing of the School Report Card System. It should further be noted that while these elements are coming from multiple sources, they should ultimately be kept within the data warehouse for historical purpose and ease of access.

### **Teacher Related**

The teacher tables are designed to answer questions like who we have teaching particular subjects, what is their overall experience and experience teaching a particular subject and geographical representation of teacher workforce.

This information can be compared against student achievement, attendance and enrollment information in order to provide the ministry with information related to the impact that teachers are having on student achievement.

## Teacher Experience

This can be accurately used only after SIS adoption (whatever date) as the data is calculated based on schedules which have not been used in any MES information systems until SIS adoption.

DWH Name	DWH Data Type	DWH Max Length	Name	Data Type	Max Length (Bytes)	Table	From
Tchr_ID	Int	9	TeacherID	Int	4	Teachers	E-students
Tchr_Exp_StartDate	Date	3	Teacher_StartDate	Date	8	SchoolTeacher	SIS
Tchr_Exp_EndDate	Date	3	Teacher_EndDate	Date	8	SchoolTeacher	SIS
Sch_ID	Int	4	School_ID	Int	4	Schools	E-students
Subj_ID	Int	4	SubjectID	int	4	Subjects	E-students

## Teacher\_Qualification

Answers questions regarding the formal qualifications of the teacher workforce and allows forecasting for retraining/recertification needs.

DWH Name	DWH Data Type	DWH Max Length	Name	Data Type	Max Length (Bytes)	Table	From
Tchr_ID	Int	9	TeacherID	Int	4		E-students
Subj_ID	Int	4	SubjectID	Int	4		E-students
Tchr_Qual_Sc	Int	3	Teacher_Qualification_Score				



## Teacher\_School

Teacher's employment history at schools

DWH Name	DWH Data Type	DWH Max Length	Name	Data Type	Max Length (Bytes)	Table	From
Tchr_ID	Int	9	TeacherID	Int	4	Teachers	E-students
Sch_ID	Int	4	School_ID	Int	4	Schools	E-students

## Teacher\_Working\_Hrs

Teacher utilization

DWH Name	DWH Data Type	DWH Max Length	Name	Data Type	Max Length (Bytes)	Table	From
Tchr_ID	Int	9	TeacherID	Int			E-students
Tchr_Hrs_Week	Int	1	Teacher_Hrs_Week				Computed from SIS
Sch_Year_Period	TinyInt	1	YearPeriodID	uniqueidentifier	16	Schedules	SIS

## Teacher Endorsement

Like the teacher certification table, this table will provide information on endorsements which a teacher might have such as IT endorsements, PE endorsements, etc., and the ministry can use this information to develop reports that look at the correlations between teacher proficiency and student achievement.

DWH Name	DWH Data Type	DWH Max Length	Name	Data Type	Max Length (Bytes)	Table	From
Tchr_ID	Int	9	TeacherID	Int	4	Teachers	E-students

Cert_ID	Int	2	Certification Code	char	10		NEW HR
Endors_ID	Int	2	Endorsement Code	char	10		NEW HR

## Schools/ERCs

The data elements contained in this section should allow the ministry to get a better understanding of the makeup and available resources at each school and ERC. This data can then be used in conjunction with student achievement and financial data to see what impact, if any, a school's makeup is having on student achievement and where resources should ultimately be committed and in what time frame.

### School Legal Information

DWH Name	DWH Data Type	DWH Max Length	Name	Data Type	Max Length (Bytes)	Table	From
Sch_ID	Int	4	SchoolID	int	4	Schools	E-students
Sch_Name	nvarchar(250)	250	FullName	nvarchar(250)	500	Schools	SIS
Dist_ID		As per CRA Standard	DistrictID	int	4	TDistrict	E-students
Sch_Code	nvarchar(20)	20	Code	nvarchar(20)	40	Schools	E-students
Sch_Address		As per CRA Standard	Address	nvarchar(100)	200	Schools	E-students
Settlement_ID		As per CRA Standard	SettlementID	Int	4	Schools	E-students
Sch_Type	Int	4	SchoolTypeID	int	4	schools	E-students
Sch_Stage	Int	4	StageID	int	4	schools	E-students
Sch_Spec	Bit	1	HasSpecDestination	Bit	1	Schools	E-students

Sch_Inclusive	Bit	1	IsInclusive	Bit	1	Schools	E-students
Sch_Year	Int	2	EducationalYearNameID	int	4	yearperiods	SIS

## School Capacity and Utilisation Information

DWH Name	DWH Data Type	DWH Max Length	Name	Data Type	Max Length (Bytes)	Table	From
Sch_ID	Int	4	SchoolID	int	4	Schools	E-students
Sch_Cap_Stud	Int	4	SchoolCapacity	Int	4	Schools	E-students
Sch_Shift1_Count	Int	4	CountInShift1	Int	4		Computed from SIS
Sch_Shift2_Count	Int	4	CountInShift2	Int	4		Computed from SIS
Sch_Count_Ext	Int	4	CountInExtension	Int	4		Computed from SIS
Sch_Class_Count	Int	2	ClassComplexesCount	Int	4		Computed from SIS
Sch_teachers	Int	3	TeachersFull	Int	4		Computed from SIS
Sch_Teach_Wom	Int	3	TeachersWomen	Int	4		Computed from SIS
Sch_Year_Period	TinyInt	1	YearPeriodID	uniqueidentifier	16	Schedules	SIS

## ERCs

DWH Name	DWH Data Type	DWH Max Length	Name	Data Type	Max Length (Bytes)	Table	From
ERC_ID	Int	3	ReourceCenterID	int	4	ReourceCenters	E-students

ERC_Name	nvarchar(50)	100	Name	nvarchar(50)	100	ReourceCenters	E-students
ERC_Address	As per CRA Standard		Address	nvarchar(200)	400	ReourceCenters	
ERC_District	As per CRA Standard		DistrictID	int	4	ReourceCenters	
ERC_Code	nvarchar(20)	20	Code	varchar(5)	5	ReourceCenters	

### School Financial Information

DWH Name	DWH Data Type	DWH Max Length	Name	Data Type	Max Length (Bytes)	Table	From
Sch_ID	Int	4	SchoolID	int	4	Schools	E-students
Sch_Spent_Plan	Decimal	8,2		Decimal	8,2		FIN Reporting (5 tables)
Sch_Spent_Act	Decimal	8,2		Decimal	8,2		FIN Reporting (5 tables)
Sch_Staff_Plan	Decimal	8,2		Decimal	8,2		FIN Reporting (5 tables)
Sch_Staff_Act	Decimal	8,2		Decimal	8,2		FIN Reporting (5 tables)
Sch_Tchr_Plan	Decimal	8,2		Decimal	8,2		FIN Reporting (5 tables)
Sch_Tchr_Act	Decimal	8,2		Decimal	8,2		FIN Reporting (5 tables)
Sch_Year_Period	TinyInt	1	YearPeriodID	uniqueidentifier	16	Schedules	SIS

**Note:** Financial data in the FIN Reporting module (5 tables) is reported on a monthly basis. This information will need to be aggregated to semesters using an ETL script.

## Students

The following data elements would provide the ministry with the needed information to be able to address questions related to student achievement and, when combined with the teacher, facilities, and financial information, see correlations that would provide the ministry with guidance on where to act and how to allocate resources.

### Student Basic Bio Data

DWH Name	DWH Data Type	DWH Max Length	Name	Data Type	Max Length (Bytes)	Table	From
Stu_Matr_#	varchar(13)	13	PupilsID	int	4	Pupils	E-students
Stu_CRA_ID	nvarchar	As per CRA standard	PersonalNumber	nvarchar(20)	40	Pupils	E-students
Stu_1_Name	nvarchar	As per CRA standard	FirstNameGeo	nvarchar(50)	100	Pupils	E-students
Stu_Last_Name	nvarchar	As per CRA standard	LastNameGeo	nvarchar(50)	100	Pupils	E-students
Stu_Fath_Name	nvarchar	As per CRA standard	FathersName	nvarchar(30)	60	Students	SIS
Stu_POB_District_ID	As per CRA Standard		PlaceOfBirth_DistrictID	nvarchar(100)	200	Students	SIS
Stu_POB_District_ID	As per CRA Standard		PlaceOfBirth_SettlementID				SIS
Stu_Gender	Int	As per CRA standard	Gender	int	4	Pupils	E-students

Stu_DOB	Date	3	DOB	datetime	8	Pupils	E-students
Stu_Legal_Address	As per CRA Standard		LegalAddress	nvarchar(200)	400	Students	SIS
Stu_PO_Index	Varchar(10)	10	LegalAddressZipCode	varchar(5)	5	Students	SIS
Stu_Reg_Date	Date	3	RegistrationDate	Date	3	Students	SIS
Stu_Phys_Add	As per CRA Standard		PhysicalAddress	nvarchar(200)	400	Students	SIS
Stu_Phys_PO_Index	Varchar(10)	10	PhysicalAddressZipCode	varchar(5)	5	Students	SIS
Stu_Soc_Vulnerable_Score	Int	3	IsSoc (currenty in the socially vulnerable list)	bit	1	Pupils	Estudents

### Student Past Association with Schools

DWH Name	DWH Data Type	DWH Max Length	Name	Data Type	Max Length (Bytes)	Table	From
Stu_Mob_Rec_ID	Int	4	MoveID	int	4	pupilmoves	E-students
Stu_Matr_#	varchar(13)	13	PupilsID	int	4	Pupils	E-students
Sch_ID	Int	4	SchoolID	int	4	Schools	E-students
Stu_Mob_Start	Date	3	Start Date				Computed from E-students
Stu_Mob_End	Date	3	End Date				Computed from E-students
Stu_Enroll_Grade	Int	1	Enrollment Grade	int			E-students

Stu_Mob_Reason_ID	Int	1	MoveTypeID	int	4	pupilmoves	E-students
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The purpose of storing this information in the data warehouse is to understand how enrollment impacts things such as attendance and achievement. We know there is a strong correlation between students staying at one school throughout their entire school year and how well they do in school, how they behave in school, and how likely it is that they will stay in school.

### Student Classes (cohorts) association

DWH Name	DWH Data Type	DWH Max Length	Name	Data Type	Max Length (Bytes)	Table	From
Stu_Matr_#	varchar(13)	13	Student ID	Int	4	pupils	E-students
Sch_ID	Int	4	SchoolID	int	4	Schools	E-students
Class_ID	Smallint	2	SchoolClassID	uniqueidentifier	16	SchoolClasses	SIS
Grade	int	1	Grade	int	4	Pupils	E-students
Sch_Year_Period	TinyInt	1	YearPeriodID	uniqueidentifier	16	Schedules	SIS

### Student Retained Information

This table would store all those students that have been retained from advancing to the next grade with a rationale attached to the record. The purpose of this table would be to provide the ministry with information on those students that it is retaining, the reason it is retaining the student, and would enhance any report that would look at achievement information on a cohort basis. Using the GIS, the ministry would be able to graph which schools seem to be having a greater number of students retained and when combined with the teacher and financial data, determine whether teacher capabilities and available resources are having an impact on why students are being retained.

DWH Name	DWH Data Type	DWH Max Length	Name	Data Type	Max Length (Bytes)	Table	From
Stu_Matr_#	varchar(13)	13	Student ID	Int	4	Pupils	E-students
Sch_ID	Int	4	SchoolID	int	4	Schools	E-students
Class_ID	Smallint	2	SchoolClassID	uniqueidentifier	16	SchoolClasses	SIS
Grade	int	1	Grade	int	4	Pupils	E-students
Stu_Retain_Comm	varchar	255	Retainment_Comment	varchar	255		SIS

## Student Grading, Attendance and Extracurricular Achievements

### Student Attendance

DWH Name	DWH Data Type	DWH Max Length	Name	Data Type	Max Length (Bytes)	Table	From
Stu_Matr_#	varchar(13)	13	Student ID	Int	4	Pupils	E-students
Sch_ID	Int	4	SchoolID	int	4	Schools	E-students
Class_ID	Smallint	2	SchoolClassID	uniqueidentifier	16	SchoolClasses	SIS
Grade	int	1	Grade	int	4	Pupils	E-students
Subj_ID	Int	4	Subject ID	int	4	Subjects	e-students
Sch_Year_Period	TinyInt	1	YearPeriodID	uniqueidentifier	16	Schedules	SIS



Sch_year	Int	2	EducationalYearNameID	int	4	yearperiods	SIS
Sch_Shift_ID	Tinyint	1	ShiftID	int	4	schedules	SIS
Tchr_ID	Int	9	Teacher_ID				SIS
Class_Mast_Tchr_ID	Int	9	Master Teacher ID				SIS
Attendance_Percent	Int	1	Attendance %				Computed from SIS

## Student Grading

DWH Name	DWH Data Type	DWH Max Length	Name	Data Type	Max Length (Bytes)	Table	From
Stu_Matr_#	varchar(13)	13	Student ID	Int	4	Pupils	E-students
Sch_ID	Int	4	SchoolID	int	4	Schools	E-students
Class_ID	Smallint	2	SchoolClassID	uniqueidentifier	16	SchoolClasses	SIS
Grade	int	1	Grade	int	4	Pupils	E-students
Subj_ID	Int	4	Subject ID	int	4	Subjects	E-students
Sch_Year_Period	TinyInt	1	YearPeriodID	uniqueidentifier	16	Schedules	SIS
Sch_year	Int	2	EducationalYearNameID	int	4	yearperiods	SIS
Sch_Shift_ID	Tinyint	1	ShiftID	int	4	schedules	SIS

Tchr_ID	Int	9	TeacherID	Int	4	Teachers	E-students
Class_Mast_Tchr_ID	Int	9	TeacherID	uniqueidentifier	16	ClassTeacher	SIS
Grade_Comp_ID	Int	1	Grade_Component_ID	uniqueidentifier	16	GradeComponents	SIS
Stu_Summ_Ass_Component	decimal(5,2)	5	Assessment	decimal(5,2)	5	StudentSummaryAssessments	SIS
Stu_Summ_Ass_Overall	decimal(5,2)	5	SummaryAssessment	decimal(5,2)	5	StudentSummaryAssessments	SIS

## Disciplinary

The current MES system – ER Officers cannot be used in the DWH as it does not uniquely identify the students through the Student ID (matriculation number), as an alternative the data structures from the SIS can be used which are designed to hold similar information.

DWH Name	DWH Data Type	DWH Max Length	Name	Data Type	Max Length (Bytes)	Table	From
Disc_Inc_ID	uniqueidentifier	16	ViolationID	uniqueidentifier	16	StudentViolations	E-students
Stu_Matr_#	varchar(13)	13	MatriculationNumber	varchar(13)	13	StudentViolations	E-students
Sch_ID	Int	4	SchoolID	int	4	StudentViolations	SIS
Disc_Inc_Type	int	1	ViolationTypeID	int	4	StudentViolations	E-students
Disc_Inc_Date	Date	3	ViolationDate	datetime	8	StudentViolations	SIS
Disc_Inc_Protocol	nvarchar(20)	40	ProtocolNumber	nvarchar(20)	40	StudentViolations	SIS

Disc_Inc_Protocol_Author	nvarchar(50)	100	ProtocolCreator	nvarchar(100)	200	StudentViolations	SIS
Disc_Inc_Comment	nvarchar(500)	1000	Comments	nvarchar(500)	1000	StudentViolations	SIS

## Possible Queries

The data structures listed above in the document make it possible to see a lot of correlations between the various factors which are relevant for analyzing how well a particular school/student is doing academically, where resources are needed or are excessive and the like.

The queries listed below can also be combined together to identify even more complex correlations.

The static information requests are not listed in this chapter since they are obvious, e.g. Average school utilization rate, average teacher experience, average academic score at school, district national level, etc.

## Educational Participation and Academic Performance

These queries relate to how student academic performance (average or per subject or group of subjects) correlates with other data.

1. Student Performance/Repetition/Promotion vs. Geographic Area (Region/District).
2. Student Performance/Repetition/Promotion vs. School Star Rating.
3. Student Performance/Repetition/Promotion vs. School Education Steps.
4. Student Performance/Repetition/Promotion vs. School (Subject) Language.
5. Student Performance/Repetition/Promotion vs. Students Social-Economic Group (IDP, Socially Vulnerable, etc.).
6. Student Performance/Repetition/Promotion vs. Disciplinary Rating of School/Student.
7. Student Performance/Repetition/Promotion vs. Teacher Workforce Formal Experience/Qualifications.
8. Student Performance/Repetition/Promotion vs. School Utilization Rate (capacity vs. enrolled).
9. Student Performance/Repetition/Promotion vs. Budget per head (of student, teacher, etc.).
10. Student Performance/Repetition/Promotion vs. Student Gender.

11. Student Performance vs. Textbooks in use.

### **School Characteristics**

1. School Teacher/Student ratio vs. Geographic Area.
2. School utilization rate vs. Geographic area.
3. School Teacher Experience/Certification ratio vs. Geographic Area.
4. School Teacher Experience/Certification ratio vs. School Main Language.
5. Teacher turnover rate vs. Geographic Area.
6. Student turnover rate vs. Geographic Area.
7. School Disciplinary Rate vs. Geographic Area.
8. School Disciplinary rate vs. Number of Students.
9. School Student Count vs. Distance from Administrative Center.
10. School Utilization vs. Population Growth Dynamics.

### **Student Absences**

- 1) Student absence vs. Teacher Experience/Qualification.
- 2) Students Absence vs. Time of the year.
- 3) Student Absence vs. Student Social Economic Background.
- 4) Student Absence vs. School Star and Disciplinary Ratings.
- 5) Student Absence vs. Budget per head (of student, teacher, etc.).